

## CLAIMS

- 1 1. A method of testing an integrated circuit, comprising:  
2  
3 obtaining periodic optical emissions over a defined period of time and from a defined  
4 area of an integrated circuit operating with time-varying internal currents;  
5  
6 time-resolving said emissions by photon timing to estimate the number of switching  
7 events occurring in said defined area over said defined period;  
8  
9 providing an optical emission model; and  
10  
11 comparing the optical emission from the area of the integrated circuit with the optical  
12 emission model to determine whether any of a group of defined conditions are present  
13 in the integrated circuit.
- 1 2. A method according to Claim 1, wherein the group of defined conditions include  
2 local power supply loading under high power density operation, and changes in  
3 switching performance due to heating effects, and mid-cycle false switching, and  
4 effectiveness of switching control circuitry, and leakage control circuitry.
- 1 3. A method according to Claim 1, wherein:  
2  
3 the obtaining step includes the step of applying a given set of instruction vectors to the  
4 integrated circuit to provide calibrated optical emissions; and  
5  
6 the time-resolving step includes the step of comparing said obtained optical emissions  
7 with said calibrated optical emissions.

1 4. A method according to Claim 1, further comprising the step of using the integrated  
2 circuit with a power distributing system having a given time constant, and wherein the  
3 time resolving step includes the step of time resolving said emissions at a resolution  
4 greater than said time constant.

1 5. A method according to Claim 1, wherein the integrated circuit has a thermal time  
2 constant, and the time resolving step includes the step of time resolving said emissions  
3 at a resolution greater than said thermal time constant.

1 6. A method according to Claim 1, wherein the defined area includes groups of  
2 switches, each of said groups having a unique signature emission waveform, and the  
3 comparing step includes the step of searching the optical emissions from the area for  
4 any of the signature emission waveforms of said groups.

1 7. A method according to Claim 6, wherein each of said groups of switches is  
2 comprised of a set of spatially unresolved individual gates.

1 8. A system for testing an integrated circuit, comprising:

2  
3 means for obtaining periodic optical emissions over a defined period of time and from a  
4 defined area of an integrated circuit operating with time-varying internal currents;

5  
6 means for time-resolving said emissions by photon timing to estimate the number of  
7 switching events occurring in said defined area over said defined period;

8  
9 means for providing an optical emission model; and

10  
11 means for comparing the optical emission from the area of the integrated circuit with  
12 the optical emission model to determine whether any of a group of defined conditions  
13 are present in the integrated circuit.

1 9. A system according to Claim 8, wherein the group of defined conditions include  
2 local power supply loading under high power density operation, and changes in  
3 switching performance due to heating effects, and mid-cycle false switching, and  
4 effectiveness of switching control circuitry, and leakage control circuitry.

1 10. A system according to Claim 8, wherein:

2  
3 the obtaining means includes means for applying a given set of instruction vectors to the  
4 integrated circuit to provide calibrated optical emissions; and

5  
6 the time-resolving means includes means for comparing said obtained optical emissions  
7 with said calibrated optical emissions.

1 11. A system according to Claim 8, wherein the integrated circuit is used with a power  
2 distributing system having a given time constant, and wherein the time resolving means  
3 includes means for time resolving said emissions at a resolution greater than said time  
4 constant.

1 12. A system according to Claim 8, wherein the integrated circuit has a thermal time  
2 constant, and the time resolving means includes means for time resolving said  
3 emissions at a resolution greater than said thermal time constant.

1 13. A program storage device readable by machine, tangibly embodying a program of  
2 instructions executable by the machine to perform method steps for testing an integrated  
3 circuit, said method steps comprising:

4  
5 obtaining periodic optical emissions over a defined period of time and from a defined  
6 area of an integrated circuit operating with time-varying internal currents;

7

8 time-resolving said emissions by photon timing to estimate the number of switching  
9 events occurring in said defined area over said defined period;

10

11 providing an optical emission model; and

12

13 comparing the optical emission from the area of the integrated circuit with the optical  
14 emission model to determine whether any of a group of defined conditions are present  
15 in the integrated circuit.

1 14. A program storage device according to Claim 13, wherein the group of defined  
2 conditions include local power supply loading under high power density operation, and  
3 changes in switching performance mobility due to heating effects, and mid-cycle false  
4 switching.

1 15. A program storage device according to Claim 13, wherein:  
2  
3 the obtaining step includes the step of applying a given set of instruction vectors to the  
4 integrated circuit to provide calibrated optical emissions; and  
5  
6 the time-resolving step includes the step of comparing said obtained optical emissions  
7 with said calibrated optical emissions.

1 16. A program storage device according to Claim 13, further comprising the step of  
2 using the integrated circuit with a power distributing system having a given time  
3 constant, and wherein the time resolving step includes the step of time resolving said  
4 emissions at a resolution greater than said time constant.

1 17. A program storage device according to Claim 13, wherein the integrated circuit has  
2 a thermal time constant, and the time resolving step includes the step of time resolving  
3 said emissions at a resolution greater than said thermal time constant.